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S2 EP4: Neptune’s Moon Triton

Maanvinder Pilania

Astrophysics: Deep In The Space With Maanvinder Pilania

Neptune’s Moon Triton

Welcome back everyone, to another exciting episode of this astronomy podcast, where we journey through the wonders of the universe. I'm your host, **Maanvinder**, and today, we're diving deep into icy depths of a fascinating celestial body or i say Neptune’s moon Triton.

Triton is the seventh largest natural satellite in the solar system and also the biggest moon of Neptune out of its 16 moons. Another fascinating thing about this moon is that it was discovered just 17 days after Neptune by a British astronomer William Lassell on October 10, 1846. Apart from galaxies and nebulas, natural satellites of planets in our solar system never fail to amaze me. I remember when I would write down the names of all moons in my science note book and dedicate a separate page for the particular moon just to add interesting facts about them and some of my favorite one include two moons of Mars, Saturn’s Moon Titan, Jupiter’s moon Io and many other small moons of Saturn. I’m sure you all are aware of that feeling where you just wanna know so much about this cosmos.

Do you know that Triton is believed to be an Kuiper belt object? If you don’t know then let me tell you why scientists thinks it’s one of those Kuiper belt objects. It is the only moon in the solar system that moves in an retrograde orbit, which means rotating opposite to the Planet’s rotation. According to current astronomical models, any moon that formed surrounding a planet will rotate in the same direction as that of the planet but in case of this moon, it’s the opposite case. That’s why scientists believe it is an Kuiper belt object that was captured by Neptune in its orbit. Another interesting thing related to its rotation is that it is tidally locked with Neptune due to its closer distance to the planet which means only one side of Triton always faces the planet and the other side remains hidden from point of view of someone who is standing on Neptune. Well you basically cannot stand on the planet but imagine that for your understanding. Okay let’s use the example of our moon. We never see the other side, the dark side of moon because it is tidally locked with the Earth.

Neptune is literally the death of this beautiful moon. You know why? Like I said earlier, Triton is tidally locked to its planet but the only difference between Triton and Earth’s moon is that Triton is way closer to its planet than our Moon is to the Earth. That is why, due to tidal interactions from Neptune, it is getting pulled into the Neptune’s orbit and once it crosses the Roche Limit of Neptune, Triton will begin to fall apart into pieces, colliding with the planet and making a new set of rings around the planet just like Saturn and this time it will be denser than the current ones. If you still don’t get it, remember the episode of previous season in which I talked about an exoplanet called WASP-12b which is being devoured by its host star as it is tidally locked and the tidal interactions from its host star continue to eat this planet. Okay so one thing I wanna make clear here is that this is not the fate of our Moon, even though it is also tidally locked. Our moon is drifting away from Earth. Scientific predictions suggests that in about 3.6 billion years, Triton will enter the Neptune’s Roche limit, thus beginning leading this moon towards its death. Another interesting thing I wanna tell you about this moon is it is one of the few

moons with atmosphere in our solar system like Saturn's moon Titan. It has a thin atmosphere composed primarily of nitrogen, smaller amounts of carbon monoxide and Methane. Carbon Monoxide was first detected back in 2010 through ground based telescopes and it was found that it is more abundant than Methane. NASA has proposed a future mission to study Triton and it is called Trident which will be launched in October 2025, arriving on the moon in 2038 to study it in more details. The last time a probe or mission to study was when Voyager 2 flew past it in August 1989 during its closest approach to Neptune, when it discovered that Nitrogen and Methane presence, confirming previous theories regarding their presence by astronomers. The atmosphere of Triton is sustained mainly due to the cryovolcanic activity on the surface of the moon, which means the eruption of gases, liquids and ice from the surface. Cryovolcanoes on the surface of Triton erupt nitrogen and other volatile liquids. This suggests the presence of a reservoir of liquid water and volatile compounds.

A day on Triton lasts for about 5.8 Earth days and due to it being tidally locked with the Neptune, there is no doubt in accepting the temperature difference between the two different sides of the moon. During its flyby Voyager 2 found the surface temperature to be -235 degree Celsius, however the temperature difference between two sides would be completely different if we take one side of the Triton that is always in dark. Even though Triton is one of the coldest objects in the solar system, it does have a heating system. Remember the tidal interactions I told you earlier about, it is because of these tidal interactions that the cryovolcanic activity is possible on this Moon, keeping liquid water beneath its frozen nitrogen surface. I asked planetary scientist & astrophysicist Sean Raymond about this to which he replied, **"**Tidal heating would be distributed evenly across Triton but solar heating would vary from one hemisphere to the next over Titan's 5.9 days orbital period around Neptune. I Titan is very far away from the Sun so it's not very warm anyways**"**. I recommend you guys to check out his blog planetplanet.net.

Triton is one of the few geologically active moons in our solar system thanks to its cryovolcanic activities due to the tidal interactions from Neptune. Also, the moon is larger than the dwarf planet Pluto at around 2710 km in diameter. It is also the largest retrograde moon in Solar System and comprises about 99.5% of total mass that orbit Neptune while the remaining moons and rings making only 0.5% of the total mass. I believe you have been surprised to know so many facts about the moon so far then let me tell you one more. Titan appears to be reddish in color. Why? Well it is because of the methane ice. That's all for today's journey through Triton. Join me next time as we embark on another cosmic adventure. Until then, keep gazing up at the stars!

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